MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

POC0335 – ORGANIC CHEMISTRY

(Foundation in Life Sciences students only)

31 MAY 2019
9.00 a.m – 11.00 a.m
(2 Hours)

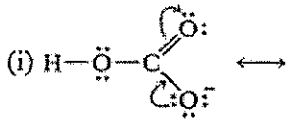
INSTRUCTIONS TO STUDENT

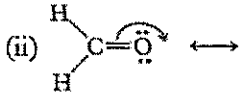
1. This question paper consists of 6 pages with 5 questions only.
2. Answer **ALL** questions.
3. Please write all your answers in the answer booklet provided.
4. Distribution of marks for each section/question is given.

Instructions: Answer **ALL** questions.

Question 1 [10 marks]

a. Draw the resonance contributing structure indicated by the curved arrow(s), and assign formal charges. [2 ×½ mark]

(i) 

(ii) 

b. The wax found in apple skins is an unbranched alkane with molecular formula $C_{27}H_{56}$. Explain how the presence of this alkane prevents the loss of moisture from within an apple. [1 mark]

c. Explain why each name is incorrect, and then write a correct name for the intended compound: [3 ×1 mark]

(i) 2-Ethyl-1-propene
(ii) 4-Methyl-4-hexene
(iii) 2-sec-Butyl-1-butene

d. Two alkenes, A and B, each have the formula C_5H_{10}. Both react with H_2/Pt and with HBr to give identical products. What are the structures of A and B? [2 ×½ mark]

e. Give the structural formula of an alkene or alkenes from which each alcohol or glycol can be prepared: [4 ×1 mark]

(i) 1-Methylcyclohexanol
(ii) 3-Hexanol
(iii) 2-Methyl-2-pentanol
(iv) Cyclopentanol

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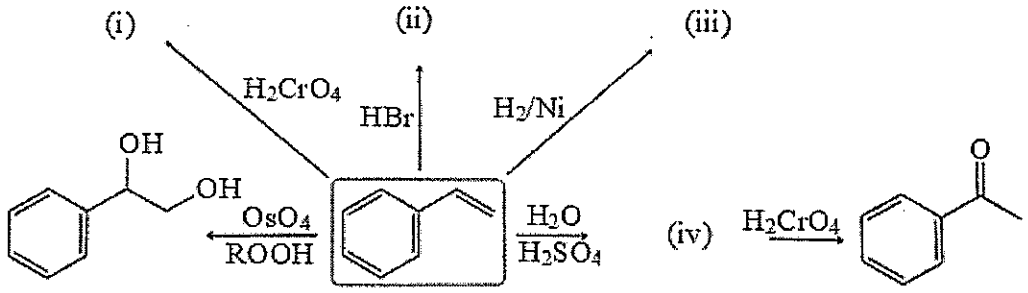
Question 2 [10 marks]

a. Using styrene as the aromatic starting material, predict the structures of the compounds formed in the following diagram. [4 ×½ mark]



b. 4-Aminobenzoic acid is a building block in the synthesis of the topical anesthetic benzocaine. Show how this building block can be synthesized in three steps from toluene. (Draw the structures, show the reagents and conditions that will bring about the conversion.) [4 marks]

c. Correct the following incorrect names: [4 ×1 mark]

(i) 2,4,6-tribromobenzene
(ii) 3-hydroxynitrobenzene
(iii) para-methylbromobenzene
(iv) 1,6-dichlorobenzene

Continued.....

Question 3 [10 marks]

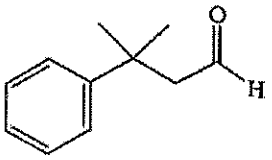
a. Draw structural formulas for the four aldehydes with molecular formula $C_5H_{10}O$. Which of these aldehydes are chiral? [3 marks]

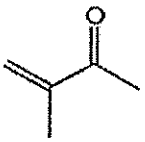
b. Show how you would bring about these conversions:

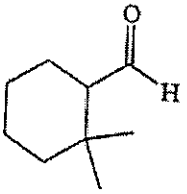
(i) 1-Pentanol to pentanal [½ mark]
(ii) 1-Pentanol to pentanoic acid [½ mark]
(iii) 1-Pentene to 2-pentanone [1 mark]

c. Name the following compounds: [4 ×1 mark]

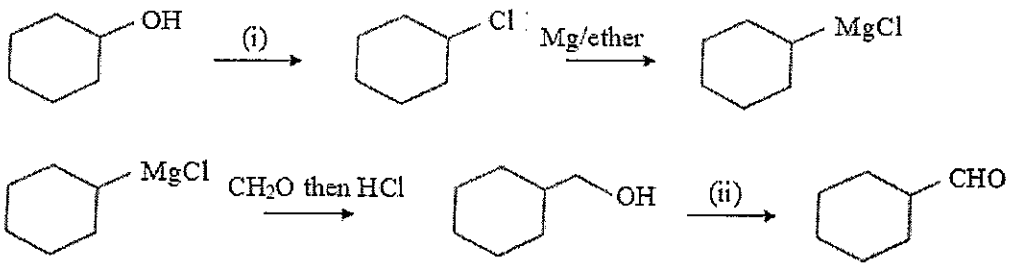
(i)

(ii) 

(iii) 

(iv) 

d. Fill in the blank for (i) and (ii) to show the reagents and conditions that will bring about the conversion of cyclohexanol to cyclohexanecarbaldehyde: [2 ×½ mark]



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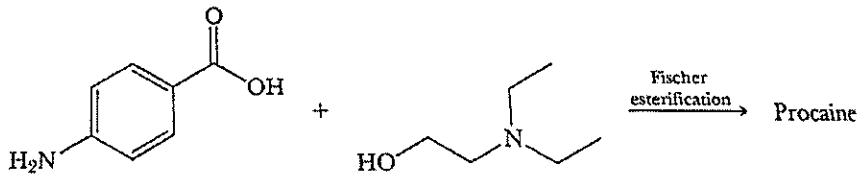
Question 4 [10 marks]

a. Name and draw structural formulas for the four carboxylic acids with molecular formula $C_5H_{10}O_2$. Which of these carboxylic acids is chiral? [3 marks]

b. Formic acid is one of the components responsible for the sting of biting ants and is injected under the skin by bees and wasps. A way to relieve the pain is to rub the area of the sting with a paste of baking soda ($NaHCO_3$) and water, which neutralizes the acid. Write an equation for this reaction. [2 marks]

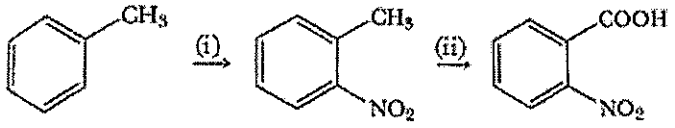
c. Procaine (its hydrochloride is marketed as Novocaine®) was one of the first local anesthetics developed for infiltration and regional anesthesia. It is synthesized by the following Fischer esterification. Draw a structural formula for procaine. [2 marks]



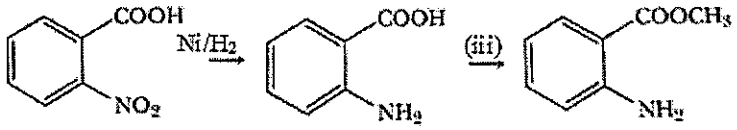
p-Aminobenzoic acid

2-Diethylaminoethanol

d. Methyl 2-aminobenzoate, a flavoring agent with the taste of grapes, can be prepared from toluene by the following series of steps:



Toluene



Methyl 2-amino-benzoate

Fill in the blank for (i), (ii) and (iii) to show the reagents and conditions that will bring about the conversion of toluene to methyl 2-aminobenzoate. [3 ×1 mark]

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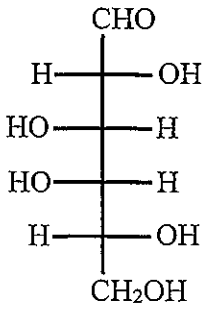
Question 5 [10 marks]



D-Galactose

Figure 1

(a) **Figure 1** is a Fisher projection of the D-Galactose molecule.

(i) Using *Haworth projections*, draw the two examples of anomers (i.e. α and β) for this molecule. Name each of the anomer accordingly and clearly indicate the *anomeric carbon* in each example. [2 × 1 mark]

(ii) Based on your β example of the anomer that you have drawn in (a) (i), depict it in the form of a *chair conformation.* [1 mark]

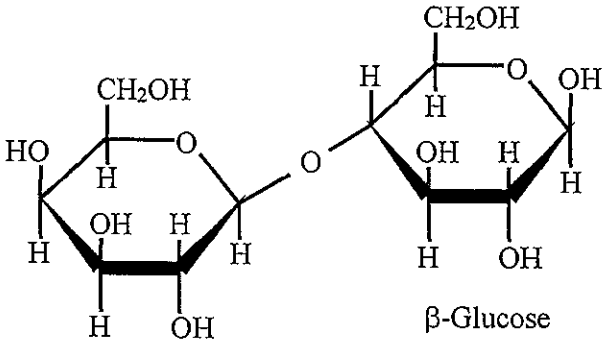


Figure 2

(b) (i) *Lactose* is made up of a β-Galactose molecule and a β-Glucose molecule as depicted in **Figure 2**. Name the *glycosidic bond* between the β-Galactose molecule and the β-Glucose molecule in *lactose* as depicted in **Figure 2.** [½ mark]

(ii) With reference to your answer in (b)(i), draw the expected structure of a *maltose* molecule if it is known that the maltose molecule is made up of two α-Glucose molecules linked by an α-1,4-glycosidic linkage. [2 marks]

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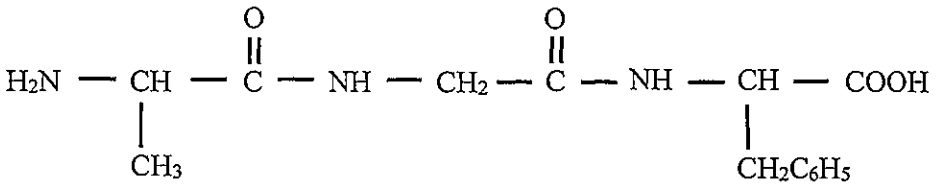

Tripeptide of Ala – Gly – Phe

Figure 3

(c) **Figure 3** depicts a tripeptide molecule made up of the amino acids of *alanine*, *glycine* and *phenylalanine*. Based on this diagram, draw the individual structures of each of these three amino acids. [3 × ½ mark]

(d) *Phospholipids* spontaneously form a *lipid bilayer* when they are placed in an aqueous solution. Based on this information, answer the following.

(i) What is a *lipid bilayer*? Explain. [2 × ½ mark]

(ii) Describe the two noncovalent forces that drive the formation of the *lipid bilayer*. [2 × ½ mark]

(iii) What is the main difference between a *phospholipid* molecule and a *triglyceride* molecule? [2 × ½ mark]

End of Paper